

## Section 1

### Loading Computer Systems

#### A. Introduction

1. These Guidelines apply to loading computer systems. A loading computer system is a computer based system consisting of a loading computer (hardware) and a loading program (software), by means of which it can be easily and quickly ascertained that in any ballast or load condition

- the longitudinal- and local strength will not exceed the permissible values, and
- the stability complies with the stability requirements applicable to the ship.

2. The use of onboard stability computers as defined by IACS Unified Requirement L5 is not required by Class. However, a stability program in-

stalled on board shall cover all stability requirements applicable to the ship.

**Note**

*The requirements in these Guidelines concerning stability apply to stability software onboard ships contracted for construction on or after 1<sup>st</sup> July 2005.*

3. These Guidelines cover passive systems and the off-line operation mode of active systems only (see C.).

4. Unless otherwise noted, the requirements to loading computer systems given in these Guidelines concern to loading instruments and onboard stability computers as well.

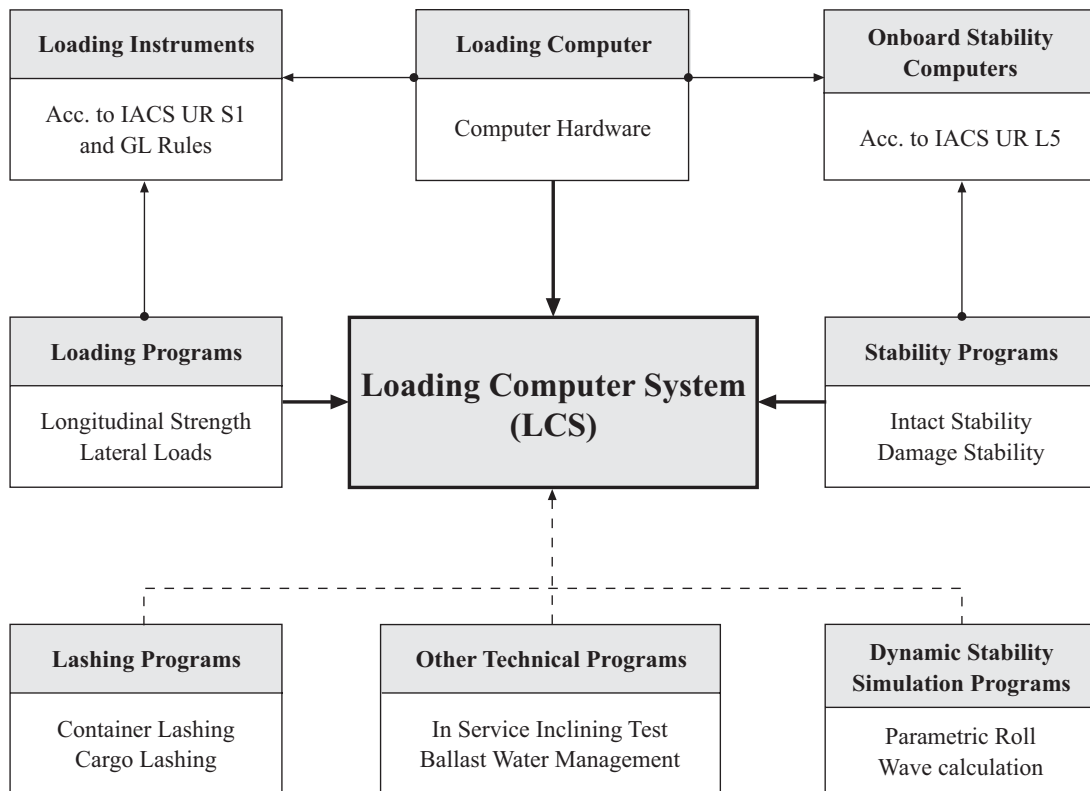


Fig. 1.1 Definition of loading computer system (LCS)

## B. General

1. The loading computer system is not a substitute for the approved loading manual respective the approved stability booklet and it is used as a supplement to these approved documents to facilitate strength and stability calculations.
2. The scope of the stability calculations carried out by the onboard stability program shall be in accordance with the stability information as approved by the administration and shall at least include all information and perform all calculations or checks as necessary to ensure compliance with the applicable stability requirements.
3. The loading computer system is a ship specific onboard equipment and the results of the calculations are applicable only to the ship for which it has been approved.
4. In case of modifications implying changes in the used main data or the internal arrangement of the ship, the ship specific approval of any original loading or stability program is no longer valid. The software is to be modified and re-approved, see J.
5. The replacement of the loading computer on board shall be notified to GL as well. Failure to advise of any modifications to the loading computer may invalidate the certification, see J.
6. It is strictly recommended that no other than ship specific, technical or organisational software will be used on the loading computer. Data protection shall include virus protection in any case.
7. An operation manual is always to be provided for the loading computer system installed on board and shall be submitted to GL for review, see H.
8. The language in which the stability- and strength information is displayed and printed out should be same as used in the operation manual, see H. GL may require a translation into a language considered appropriate.
9. The input/output information of the loading computer system shall be easily comparable with the approved stability information and the loading manual so as to avoid confusion and possible misinterpretation by the operator relative to the stability information and loading manual.
10. Single point strength calculators are not acceptable.

## C. Calculation Systems and Software Types

### 1. Calculation systems

Generally, three different calculation systems are specified:

- A passive system requiring manual data input,
- an active system replacing the manual input by sensors reading and entering the contents of tanks, etc. and
- an integrated system, which controls or initiates actions based on the sensor-supplied inputs and this is not within the scope of these Guidelines.

These Guidelines covers passive systems and the off-line operation mode of active systems only.

### 2. Types of stability calculation software

Three types of calculation performed by the stability module are acceptable depending upon a vessel's stability requirements:

- Type 1  
Stability program calculating intact stability only (for vessels not required to meet a damage stability criterion).
- Type 2  
Stability program calculating intact stability and checking damage stability on the basis of a limit curve (e.g. vessels applicable to SOLAS Part B-1 damage stability calculations etc.) or previously approved loading conditions.
- Type 3  
Stability program calculating intact stability and damage stability by direct application of pre-programmed damage cases for each loading condition (for some tankers etc.).

#### Note

*For such tankers where an approved damage stability limiting curve is not available, an installation of Type 3 software is strictly recommended. Otherwise, any actual load case must not deviate significantly from those loading conditions as approved in respective stability booklet.*

## D. Functional Requirements

1. The loading computer system shall present relevant parameters of each loading condition in order to assist the Master in his judgement on whether the ship is loaded within the approval limits. The following parameters shall be presented for a given loading condition:

**1.1 With regard to strength**

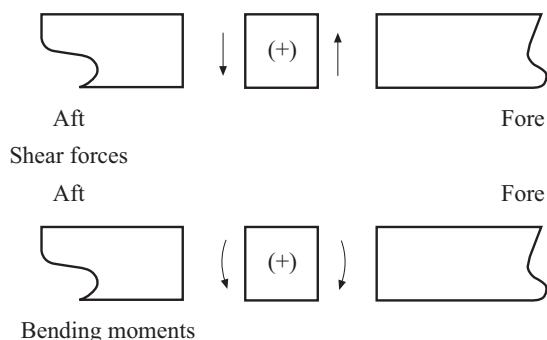
- Calculation of actual still water shear forces SF, bending moments BM at the predefined read-out points obtained by GL and comparison with the permissible values in tabular and graphical format.
- Actual and allowable static torsional moments TM along the ship's length or at the relevant read-out point in tabular and graphical format, if applicable.
- Ship weight- and buoyancy distribution
- Local loads in the holds and the double bottom
- Shear force corrections according to GL Rules (see E.1.4), if applicable, shall be shown in graphical and tabular form.
- Check of the allowable mass of cargo and double bottom contents in way of each cargo hold and in any two adjacent holds as a function of the ship's draught at mid-hold positions, if applicable.
- Calculations of still water shear forces and bending moments in the hold flooded conditions according to GL Rules I – Ship Technology, Part 1 – Seagoing Ships, Chapter 1 – Hull Structures, Section 5, F., if applicable.

**1.1.1 Output**

The loading program should be capable of producing printouts of the results in both numerical and graphical form. For the calculation of still water shear forces, bending moments and static torsional moments the numeric values shall be shown in both, absolute values and as the percentage of the allowable value (see 1.1.3.).

**1.1.2 Sign convention**

For the calculation of still water shear forces and bending moments downward loads are assumed to be taken as positive values, and are to be integrated in the forward direction from aft end of the ship's length.



**Fig. 1.2 Sign Convention**

**1.1.3 Calculation of percentage values**

In normal case when the hogging limit is on positive side and the sagging limit is on the negative side, the bending moment percentage value is as always presented as:

$$\frac{\text{actual value}}{\text{actual limit}} \cdot 100$$

When both bending moment limits are on the same side of zero the bending moment percentage value will be presented as:

$$\frac{(\text{actual value} - \text{low limit})}{(\text{high limit} - \text{low limit})} \cdot 100$$

or

$$\frac{(\text{high limit} - \text{actual value})}{(\text{high limit} - \text{low limit})} \cdot 100$$

as long as the actual value is below the half point between the high and the low limit

**1.2 With regard to stability**

- deadweight data
- light ship data
- trim
- draft at the marks and at the perpendiculars
- summary of the loading condition Displacement, VCG, LCG and TCG, if applicable
- downflooding angle and corresponding downflooding openings
- compliance with the stability criteria: Listing of all calculated stability criteria, the limit values, the obtained values and the conclusions (criteria fulfilled or not fulfilled).

**1.2.1** If direct damage stability calculations are performed, the relevant damage cases according to the applicable Rules shall be pre-defined for the automatic check of a given loading condition.

**2.** A clear warning shall be given on screen and in the hardcopy printout if any of the loading limitations is not complied with.

**3.** All stability and strength data are to be presented on the screen and in the hard copy printout in a clear unambiguous manner.

**4.** The date and the time of a saved calculation shall be a part of the screen display and the hard copy printout.

**5.** Each hard copy printout shall contain the identification of the calculation program including the version number, the ship's name and a description of the corresponding loading condition.

6. Units of measurement are to be clearly identified and used consistently within the loading conditions.
7. Protection against unintentional or unauthorized modification of the programs and data shall be provided. Pre-programmed ship's basic data like light-weight distribution, tank tables, hydrostatic data, permissible strength limits, the stability limitations etc. shall be protected against unauthorized modification.
8. The loading computer system shall monitor operation and activate an alarm when the program is incorrectly or abnormally used.
9. The programs and any data stored in the system shall be protected from corruption by loss of power.
10. Error messages with regard to limitations such as filling a compartment beyond capacity, or exceeding the assigned load line, etc. shall be included.
11. The calculation of the navigation bridge visibility shall be carried out according to SOLAS Chapter V Reg. 22.

**E. Additional Guidance Notes**

**1. With regard to strength**

**1.1 Torsional moments**

The calculation of the static torsional moments applies to all ships with large deck opening as defined in GL Rules I – Ship Technology, Part 1 – Seagoing Ships, Chapter 1 – Hull Structures, Section 5, F., if applicable.

The permissible static torsional moment and the area  $A_{St}$  under static torsional moments curve shall not exceed the permissible values that are calculated by GL. The actual torsional moment is to be zero at both ship ends. Typical curves for the transverse and the buoyancy moments are given in Fig. 1.3. and 1.4.

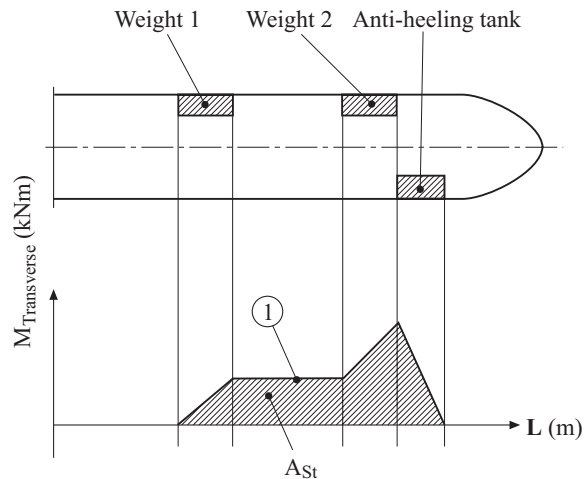
**1.2 Cargo hold mass diagrams (HMD)**

The loading program shall be capable to carry out a check of the cargo hold masses, if such diagrams approved by Class are available for the respective ship.

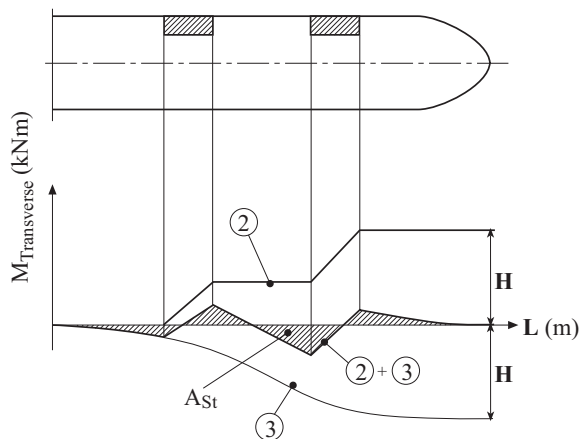
- The check of cargo hold mass shall be carried out automatically by the loading program.
- The results may be listed in a tabular overview. However, a graphical format may be helpful as well.

It should be noted that the double bottom content is considered by the yards in different ways:

- The double bottom contents are to be added to the actual cargo load before comparison with permissible limits, or
- the double bottom contents have already been considered during the calculation of the HMD.



**Fig. 1.3 Static torsional moments with anti-heeling tank**



- ① : Transverse moments due to unsymmetric weights (e.g. Cranes) and anti-heeling tank ( $\varphi = 0$ )
- ② : Transverse moments due to unsymmetric weights (e.g. Cranes) without anti-heeling tank ( $\varphi \neq 0$ )
- ③ : Buoyancy moment due to heeling ( $\varphi \neq 0$ )
- $A_{St}$  : Area under the static torsional moment curve
- $\varphi$  : Inclination of the ship

**Fig. 1.4 Static torsional moments without anti-heeling tank**

### 1.3 Cargo hold flooded condition

The calculation of cargo holds under flooded conditions applies to single side skin bulk carriers only as defined by Rules. The check of flooded condition is to be carried out for such holds only which are single side skin holds.

- The permissible still water shear forces and bending moments for flooded conditions are calculated by the GL. These limits shall be included into the loading program.
- The still water shear forces and bending moments under flooded conditions should be shown on screen and in printed format in a clear format (tables, diagrams).
- The actual values are to be compared to with the limit values. Percentage values shall be listed as well.
- The loading program shall allow to select or enter the appropriate permeability for the cargo density. Please observe the notes given within the GL Rules I – Ship Technology, Part 1 – Seagoing Ships, Chapter 1 – Hull Structure, Section 5, G.

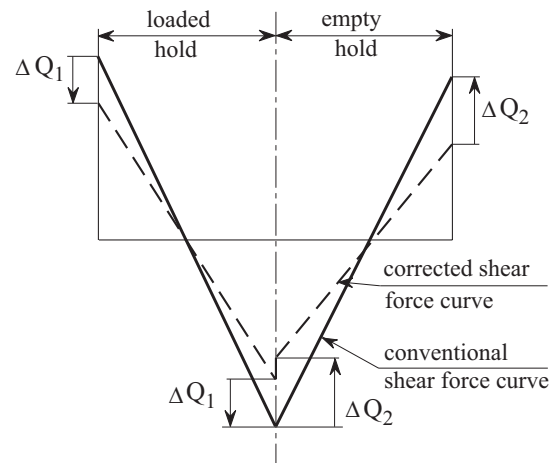
Empty spaces within the cargo hold area shall be recognized by the loading program and these spaces are to be calculated with a permeability of 0,95.

### 1.4 Shear force correction

Shear force corrections apply to those bulk carriers, ore carriers or combination carriers only where a Class Notation has been assigned for alternate loading, e.g. {holds..... may be empty}.

- The loading program shall be capable to calculate shear force corrections, where applicable. The shear force correction coefficients **u** and **v** are always calculated by GL, if the vessel is intended to be loaded alternated.
- The user shall be able to select manually between "alternate" loading and "normal" loading.
- The corrected still water shear forces and relative shear force correction coefficients shall be listed in tabular form and the uncorrected and corrected still water shear forces shall be displayed in graphical form (stress curves).
- The shear force corrections apply to the read out points at the cargo bulkheads only. The shear forces at the foremost and the machinery front bulkhead must not to be corrected.

**1.4.1** The supporting forces of the bottom grillage at the transverse bulkheads may either be determined by direct calculation or by approximation, according to 1.4.2.



**Fig. 1.5 Correction of shear force curve**

**1.4.2** The sum of the supporting forces of the bottom grillage at the aft or forward boundary bulkhead of the hold considered may be determined by the following formulae:

$$\Delta Q = u \cdot P - v \cdot T^* \quad [\text{kN}]$$

**P** = mass of cargo or ballast [t] in the hold considered, including any contents of bottom tanks within the flat part of the double bottom

**T\*** = draught [m] at mid length of the cargo hold

**u, v** = correction coefficients for cargo and buoyancy as follows:

$$u = \frac{10 \cdot \kappa \cdot \ell \cdot b \cdot h}{V} \quad [\text{kN/t}]$$

$$v = 10 \cdot \kappa \cdot \ell \cdot b \quad [\text{kN/m}]$$

$$\kappa = \frac{B}{2,3 (B + \ell)}$$

**ℓ** = length of the flat part of the double bottom [m]

**b** = breadth of the flat part of the double bottom [m]

**h** = height of the hold [m]

**V** = volume of the hold [m<sup>3</sup>]

The actual shear force may be corrected whenever the hold cargo masses in two adjoined holds are different, e.g. hold 1 filled 50 % and hold 2 is filled with 20 %. That means the SF correction may not be used in case of alternated loading only (e.g. hold 1 full, hold 2 empty, hold 3 full etc.).

**2. With regard to stability**

**2.1 Calculation of free surface correction**

For the pre-calculation of arrival or intermediate loading conditions the stability program shall allow the user a manual selection of the free surface moments (FSM) as follows:

- The maximum FSM, independent from the degree of tank filling, for each tank or pair of tanks, (taken from the approved stability information), or
- the actual FSM value corresponding to on the degree of filling of the respective tank or pair of tanks (taken from the pre-programmed tank tables and/or tank geometric description).

However, the program should not allow the user to manually input any FSM value that is less than the maximum FSM.

**F. Acceptable Tolerances**

**1. With regard to longitudinal strength**

The computational accuracy of the loading program should be within the acceptable tolerance band, specified in the following, of the results at each read-out point obtained by GL using an independent program or the approved loading manual with identical input:

- still water shear force:  $\pm 5\%$
  - still water bending moment:  $\pm 5\%$
  - still water torsion moment:  $\pm 5\%$
- (As percentage of the permissible value)

**2. With regard to stability**

Depending on the type and the scope of the stability program, the acceptable tolerances are to be determined differently (see 2.2.1 and 2.2.2). Deviations from these tolerances shall not be accepted unless GL considers that there is a satisfactory explanation for the differences and that there will be no adverse effect on the safety of the ship.

Examples for pre-programmed input data include the following:

- Hydrostatic data:  
Displacement, LCG, LCF, VCB, KMT, and MCT versus draught.

- Stability data:

KN or MS values at appropriate heel/trim angles versus displacement, stability limits.

- Compartment data:

Volume, LCG, VCG, TCG and FSM, Grain heeling moments versus level of the compartment's contents.

Examples for output data include the following:

- Hydrostatic data:

Displacement, LCG, LCF, VCB, KMT, and MCT versus draught as well as actual draughts, trim.

- Stability data:

Free surface correction, GZ-values, KG, GM, KG/GM limits, allowable grain heeling moments, derived stability criteria, e.g. areas under the GZ curve, weather criteria.

- Compartment data:

Calculated volume, LCG, VCG, TCG and FSM, Grain heeling moments versus level of the compartment's contents.

The computational accuracy of the stability calculation results shall be within acceptable tolerances specified below, of the results using an independent program or the approved stability booklet with identical input.

**2.1** Stability programs which use only pre-programmed data from the approved stability booklet as the basis for the stability calculations, shall have zero tolerances for the printouts of input data.

**2.2** Output data tolerances are to be close to zero, however, small differences associated with the calculation rounding or abridged input data are acceptable. Additionally, differences associated with the use of hydrostatic and stability data for trims that differ from those in the approved stability booklet, are acceptable.

**2.3** Stability programs which use hull form models as their basis for the stability calculations, shall have tolerances for their printouts of basic calculated data established against either data from the approved stability booklet or data obtained using the approval GL model. Acceptable tolerances shall be in accordance with Table 1.1

**Table 1.1 Acceptable tolerances**

<b>Hull Form Dependent</b>	
Displacement	2 %
Longitudinal centre of buoyancy, from AP	1 % / 50 cm max.
Vertical centre of buoyancy	1 % / 5 cm max.
Transverse centre of buoyancy	0,5 % of <b>B</b> /5 cm max.
Longitudinal centre of flotation, from AP	1 % / 50 cm max.
Moment to trim 1 cm	2 %
Transverse metacentric height	1 % / 5 cm max.
Longitudinal metacentric height	1 % / 50 cm max.
Cross curves of stability	50 mm
<b>Compartment Dependent</b>	
Volume or deadweight	2 %
Longitudinal centre of gravity, from AP	1 % / 50 cm max.
Vertical centre of gravity	1 % / 5 cm max.
Transverse centre of gravity	0,5 % of <b>B</b> /5 cm max.
Free surface moment	2 %
Shifting moment	5 %
Level of contents	2 %
<b>Trim and Stability</b>	
Draughts (forward, aft, mean)	1 % / 5 cm max.
GMt	1 % / 5 cm max.
GZ values	5 % / 5 cm max.
FS correction	2 %
Downflooding angle	2 %
Equilibrium angles	1 %
Distance to unprotected openings or margin line from WL, if applicable	± 5 % / 50 mm
Areas under righting arm curve	50 % or 0,0012 mrad
Deviation in % = $\frac{(\text{base values} - \text{applicant's value})}{\text{base value}} \cdot 100$ Where the "base value" may be from the approved stability information or the GL computer model.	

**G. Approval Procedure**

**1. Approval conditions of loading computer systems**

**1.1** The loading computer system is subject to an approval process which includes the following procedures:

- verification that the data used is consistent with the current condition of the ship (refer to G.2.1.3. Ship's Specific Approval)
- verification and approval of the test conditions
- verification that the software is appropriate for the type of ship and strength/stability calculations required
- verification of type approval of computer hardware, if applicable
- checking of a proper installation and operation of the instrument on board in accordance with agreed test conditions
- issuance of the test certificate of the program installation

**1.2** The satisfactory operation of the loading computer system is to be verified by testing upon installation, see [Annex C](#). A copy of the approved test conditions and the operation manuals (see [I.](#)) for the computer/software are to be available on board.

**2. Ship's specific approval**

**2.1 With regard to loading programs and stability programs**

**2.1.1 General**

GL will verify the accuracy of the computational results and actual ship data used by the programs for the particular ship on which the programs will be installed. Concerning preliminary approval of loading programs see 2.2.

The ship specific approval of on-board loading instruments is required for all ships belong to Category I as defined in the Rules [I – Ship Technology, 1- Seagoing Ships, Chapter 1 –Hull Structures, Section 5](#). In special cases, e.g. extreme loading conditions or unusual structural configurations, GL may also require an approved loading instrument for ships of Category I less than 100 m in length.

**Note**

*It is strictly recommended that the programs are developed in accordance with international quality standards like ISO 9000-3 or equivalent.*

### 2.1.2 Test loading conditions

Upon application to GL for data verification, GL and the applicant shall agree on a minimum of four loading conditions, taken from the ship's approved stability booklet and loading manual, which are to be used as the test conditions.

For ships carrying liquids in bulk, at least one of the test conditions shall include partially filled tanks. For ships carrying grain in bulk, one of the grain conditions shall include a partially filled grain compartment.

Within the test conditions each compartment shall be loaded at least once. The test conditions normally are to cover the range of the load draughts from the deepest envisaged loaded condition to the light ship condition and shall include at least one departure and one arrival condition.

If on-board damage stability computations are requested, the loading conditions shall be taken from the approved stability booklet after consultation with GL.

Data to be submitted by the applicant are outlined in [Annex A](#).

### 2.1.3 Data verification

It is important that the data contained in the programs are consistent with the data specified in the approved stability booklet and loading manual. Particular attention is drawn to the final lightship weight and centres of gravity.

GL is to verify that the following data, submitted by the applicant, are consistent with the arrangements of the ship according to the current plans and documentations on the file with the GL:

- identification of the loading program including the version number
- main dimension, hydrostatic particulars and predefined stability limiting values, if applicable, the ship profile
- the position of the forward and aft perpendiculars, and if appropriate, the calculation method to derive the forward and the aft draughts at the actual position of the ship's draught marks
- final light ship data and centre of gravity including light ship distribution along the ship's length
- lines plan, offset tables or other suitable presentation of hull form data if necessary for GL to model the ship
- compartment definitions, including frame spacing, and centres of volume, together with capacity tables (sounding/ullage tables), free surface corrections, if appropriate
- deadweight definitions (cargo and consumables distribution) of each loading condition
- acceptance of the number and position of predefined read-out points for still water shear forces,

bending moments and static torsional moments and shear force correction factors, if applicable

- acceptance of relevant strength limits for all read out points
- acceptance of local strength limits (allowable cargo hold masses etc.), if applicable

In case that the strength limit values are not available in the Classification documents submitted to GL, additional costs will be charged by GL for their calculation.

The verification by GL does not absolve the applicant and the ship owner of responsibility for ensuring that the information programmed into the onboard computer software is consistent with the current condition of the ship.

### 2.1.4 Certification

After the data verification has been completed an approval certificate for acceptance of the loading computer system will be issued by GL. The following information is specified:

- type and name of soft- and hardware
- Register No., IMO No., Hull No. and Yard
- specification of the range of approval (applicable Rules etc.) and additional approval remarks to the specific loading computer system
- approval date and certification number

### 2.1.5 Installation test

An extensive plausibility check will be performed on a computer in the GL Head Office provided that the program can be installed under Windows and/or DOS-Versions.

Finally, the loading instrument is to be tested in accordance to the test procedure outlined in [Annex C](#) on board of the ship. This shall be done in the presence of a GL Surveyor.

### 2.1.6 Periodical testing

It is the responsibility of the ship's master to check the accuracy of the loading computer system at each Annual survey by applying at least one approved test loading condition (other than light ship). If a Surveyor is not present for the computer check, a copy of the test conditions results obtained by the computer check is to be retained on board as documentation of satisfactory testing for the surveyor's verification.

### 2.1.7 Documents on board

The following documents shall be filed on board:

- the approved test loading conditions, stamped and signed by GL
- the approval certificate for acceptance of the loading computer system

- at least one hardcopy of the operation manual (see H.)

Self-adhesive proof labels will be fixed on the loading computer casing after the approval of the loading- and stability program has been finalized and the onboard test has been carried out successfully on the on board loading computer.

## 2.2 Preliminary Approval Loading Programs

### 2.2.1 General

In order to continually improve the ship's safety, Germanischer Lloyd require the preliminary approval of the loading instrument before the delivery of the ship.

This preliminary approval will cover all longitudinal strength calculations carried out by the loading instrument.

The final approval of the instrument will be carry out after the final data are implemented in the loading instrument and after the final stability booklet/loading manual has been approved, see 3.

### 2.2.2 Validity

This requirement applies to seagoing ships contracted for construction on or after **1<sup>st</sup> October 2004** and when the installation of an approved loading instrument is required by GL, see 2.1.1.

### 2.2.3 Submission of documents

Two test load cases calculated with the preliminary program version shall be submitted for approval to GL Head Office, Dept. NHO by the supplier of the software. These test cases are to be taken from the preliminary loading manual and stability booklet:

- ballast departure and
- one cargo load case on full draught

In order to avoid any delays, the test cases may be send via e-mail (pdf.-format) to the email addresses:

*dirk.lange@gl-group.com*

or

*christophe.vareillas@gl-group.com*

In addition, detailed information on the loading computer hardware (type, supplier) that is installed on board is needed.

### 2.2.4 Approval of the documents

GL Head Office will check the test cases from longitudinal strength point of view. The preliminary approved test cases and the preliminary Certificate for acceptance of the loading instrument (soft- and hardware) will be sent to GL's local site office in charge.

### 2.2.5 Onboard test by Surveyors

In order to ensure the correct working of the loading instrument on board after the software has been installed, an onboard test will be carried out in the presence of the local Surveyor (see [Annex C](#)). After this test has been carried out satisfactorily, the Surveyor will hand over the approved test cases and the preliminary Certificate to the ship's management.

### 2.2.6 Approval costs

In general GL will not charge additional costs for the preliminary approval of the loading program provided that the above procedure can be carried out step by step without any revisions of the preliminary loading program. Otherwise additional costs calculated on time spent basis are to be taken into account.

## 2.3 Lashing programs

An installation of an approved lashing program is not required.

### Note

*The approval of the lashing program is strictly recommended*

Upon request GL examines and approves calculation programs for the determination of forces in the lashing system based on the test load cases in accordance to GL Rules [I – Ship Technology, Part 4 – Special Equipment, Chapter 3 – Stowage and Lashing of Containers](#). This examination and the corresponding approval are only done with relation to a particular ship and will be certified separately to the certificate of the loading instrument.

## 2.4 Inclining programs

For approval of In service Inclining Test Systems see Rules for Classification and Construction [VI – Additional Rules and Guidelines, Part 11 – Other Operations, Chapter 8 – Guidelines and Approval Procedure for "In service Inclining Test Systems \(ISITS\)"](#).

## 3. General Approval (optional)

**3.1** Upon application to GL for general approval the loading and stability program, GL may provide the applicant with test data consisting of two or more design data sets, each of which is to include a ship's hull form data, compartmentation data, lightship characteristics and deadweight data, in sufficient details to accurately define the ship in it's loading condition. Acceptable hull form and compartmentation data may be in a form of surface coordinates for modelling the hull form and compartment boundaries, e.g. a table of offsets, or in a form of pre-calculated tabular data, e.g. hydrostatics tables, capacity tables, etc., depending upon the form of data used by the software being submitted for approval (see [Annex B](#)). Alternatively,

the general approval may be given based on at least two test ships agreed between GL and the applicant.

**3.2** In general, the software is to be tested for two types of ships for which approval is requested, with at least one design data set for each of the two ships. Where approval is requested for only one type of ship, a minimum of two different hull forms of that type of ship are required to be tested. For the calculation software which is based on the input of the hull form data, design data sets shall be provided for three types of ships for which the software is to be approved, or a minimum of three data sets for different hull forms if approval is requested for only one type of ship. Representative ship types which require different design data sets due to their hull forms, typical arrangements, and nature of cargo include: tankers, bulk carriers, container ships, and other dry cargo and passenger ships.

**3.3** The test data sets shall be used by the applicant to run the calculation program for the test ships. The results obtained (together with the hydrostatic data and cross-curve data developed of the program's computational accuracy. GL will perform parallel calculations using the same data sets and a comparison of these results will be made against the applicant's submitted program results.

**3.4** Upon satisfactory completion, a respective certificate of acceptance will be issued which is valid only for the identified, specified version of the software and has a period of validity of 5 years.

## H. Operation Manual

A simple and straightforward operation manual is to be provided, containing descriptions and instructions, as appropriate, for at least the following:

- installation
- function keys
- menu keys
- input and output data
- required minimum hardware to operate the software
- use of the test loading conditions
- computer-guided dialogue steps
- list of warnings

The operation manual should be devised in a concise and unambiguous manner and must be prepared in a language understood by the users. If this language is not English, a translation into English is to be included.

## I. Loading computer (Hardware)

### 1. General

The loading computer must be type tested and certified. The type approval may be waived, if redundancy is ensured by an installation of a certified second loading computer system. The type approval is required if:

- the computers are installed on the bridge or in adjacent spaces (acc. SOLAS Chapter V, Regulation 17)
- interfaces to other systems of the ship operation are provided

### 2. Hardware type approval

The hardware type approval should be carried out in accordance with [Part 7 – Guidelines for the Performance of Type Approvals, Chapter 1 – Procedures and Chapter 2 – Test Requirements for Electrical/Electronic Equipment and Systems](#).

The certificate, issued by GL after type approval, will be valid for 5 years and will be entered in the electronic list of type tested and approved products on GL's home page, accessible via:

*[www.gl-group.com/Client Support/Approval Finder/Type Approvals/Electrical/Type Approval...](http://www.gl-group.com/Client%20Support/Approval%20Finder/Type%20Approvals/Electrical/Type%20Approval...)*

**2.1** In case the type approval has been already carried out by another IACS Classification Society or a recognised independent laboratory, some of the type approval tests already successfully performed may be accepted by GL, provided that all relevant GL requirements have been considered. This has to be documented.

**2.2** For loading computers, which are generally installed in dry control rooms outside of machinery spaces, Environmental Category E may be accepted in accordance with [Part 7 – Guidelines for the Performance of Type Approvals, Chapter 2 – Test Requirements for Electrical/Electronic Equipment and Systems, Table 3.33](#).

In addition, computers which are intended to be a part of ship's network should be approved in accordance with the Rules of GL.

## J. Modifications

GL is to be informed about any modifications which may effect the approved loading computer system installed on board of the ship. GL will decide about a re-approval case by case. If the modifications have an effect on

- the ship's main/basic data (e.g. lengthening of the ship, increasing of the draught, (de-) installation of cranes etc.), or
- the calculation of the longitudinal strength, the local strength or the lashing, or
- the intact and damage stability calculations, or
- the loading computer (hardware)

the re-examination of the loading instrument is required by GL in any case. The approval certificate becomes invalid.

Normally, the costs for re-approval of the loading instrument will be charged on time spent basis. For costs for re-approval caused by upgrading the loading computer only, see the actual leaflet "Fees for the Approval of Loading Computer Systems", available at GL Head Office, Hamburg, Dept. NHO.

**K. Abbreviations**

- ETM = moment to change of trim
- FSM = free surface moment
- GM = metacentre above centre of gravity
- GM' = corrected metacentre above centre of gravity
- GZmax = maximum righting lever arm

- GZ = righting lever arm
- KG = vertical centre of gravity
- KMT = transversal metacentric height
- KN = stability cross curves
- LCB = longitudinal centre of buoyancy
- LCF = longitudinal centre of flotation
- LCG = longitudinal centre of gravity
- L<sub>pp</sub> = length between perpendiculars
- MCT = see ETM
- MS = mid ship
- TA = draught at aft perpendicular
- TF = draught at forward perpendicular
- TCG = transverse centre of gravity
- VCB = vertical centre of buoyancy
- VCG = vertical centre of gravity
- VCG' = corrected vertical centre of gravity